

Design Proposal of Detection System for Gamma-ray Monitoring in Groundwater at Decommissioning Site

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The real time detection system was conceptually designed for monitoring beta- and gamma-ray in groundwater of decommissioning site. Periodic groundwater monitoring at the site before/after the decommissioning of nuclear facilities is necessary, and long-term groundwater radioactivity monitoring is necessary especially in the case of restrictive release after restoration of the decommissioning site. Therefore, in order to determine the possibility of restrictive release of groundwater from the decommissioning site, we intend to develop a real-time combined on-site monitoring technology capable of simultaneously monitoring beta- and gamma-ray including tritium. In the previous research, the tritium and beta-ray monitoring technology has been developed, and the development of gamma-ray monitoring technology is ahead. In this study, a detection system was proposed for the development of gamma-ray monitoring technology (Fig. 1). The detectors are NaI(Tl) inorganic scintillator suitable for gamma-ray measurement, located above and below the sample, respectively. To obtain a signal of incident radiation, a high voltage supply (556, ORTEC, TN) is used to apply an operating voltage to the photomultiplier tube (PMT)(R878, HAMAMATSU, JP). The two output signals of PMT are amplified simultaneously using a dual amplifier (855, ORTEC, TN). The amplified signals use timing single channel analyzer (SCA)(551, ORTEC, TN) and time to amplitude converter (567, ORTEC, TN) based coincidence method to minimize the effect of background. The signal acquired by the coincidence method is digitized through multi-channel analyzer (MCA)(EASY-MCA 2K, ORTEC, TN), and the spectrum is acquired using the MAESTRO program. In future study, the geometry of NaI(Tl) detector will be optimized using Monte Carlo computing simulation to measure major gamma-ray nuclides in groundwater (¹³¹I, ¹³⁷Cs, etc.), and a detection system will be setup.

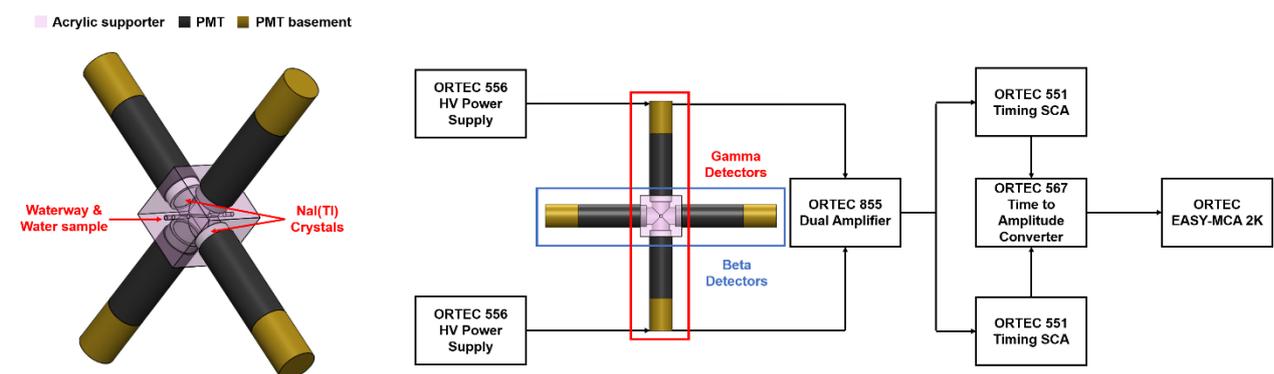


Fig. 1. Schematic diagram of the detection system design proposal.

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